GAUUTAM BUDDHA UNIVERSITY, GREATER NOIDA

SYLLABUS FOR M.Sc. APPLIED PHYSICS: GBU-ET

Mechanics and Relativity

Frames of reference, Newton's laws of motion, Centre of mass, Work and energy, Conservative and non-Conservative forces, Angular velocity and angular momentum, torque, conservation of angular momentum, Moment of inertia, Calculation of Moment of Inertia of some simple objects, Motion in central field, Two particle central force problem and reduced mass. Special theory of relativity, Galilean invariance, Michelson- Morley experiment, length contraction, time dilation, relativistic addition of velocities, Mass variation with velocity and Mass energy equivalence.

Electricity and Magnetism

Dimensional analysis, Vector algebra (scalar and vector product), gradient, divergence, curl and their significance, vector integration, line, surface and volume integrals of vector fields, Electrostatic field, electric flux, Gauss theorem and its applications due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, plane charged sheet. Electric potential as line integral of electric field due to a point charge, electric dipole and uniformly charged spherical shell, Capacitance of parallel plate, Electric polarization of matter, Polarization and displacement vectors. Biot-Savart law and its applications, Ampere's Circuital law, Magnetic permeability and susceptibility, Dia, para and ferromagnetism, Hysteresis loop. Electromagnetic induction, Faraday's law, Lenz's law, self and mutual inductance. Equation of continuity, displacement current, Maxwell's equations, Poynting vector, electromagnetic wave propagation through vacuum and isotropic dielectric medium, transverse nature of EM waves.

Waves and optics

Superposition Principle, Beats, Transverse waves on a string, travelling and standing waves on a string, normal modes of a string, group velocity, phase velocity, spherical waves, Simple harmonic motion., Differential equation of wave motion, Lissajous figures, Damped and forced oscillations. Interference, Fresnel's bi-prism, Interference in thin film, Newton's rings, Michelson Interferometer. Diffractions, Fraunhofer diffraction- single slit and double slit. Resolution, Rayleigh criteria, resolving power of prism and Grating, Polarization, Malus law, Brewster's law, Double refraction, Nicol prism, Production and detection of plane, Circular and elliptically polarized light.

Thermodynamics

Kinetic theory of gases, Specific heat, Mean free path, Absolute scale of temperature, Zeroth law of thermodynamics, First law of thermodynamics, Isothermal and adiabatic processes, Reversible and irreversible processes, Second law of thermodynamics and Entropy, Carnot's engine and Carnot's theorem, Entropy changes in reversible and irreversible processes, entropy-temperature diagrams, third law of thermodynamics, unattainability of absolute zero, Enthalpy, Gibbs, Helmholtz and Internal energy functions, Maxwell's thermodynamically relations, Clausius-Clapeyron's heat equation, Energy distribution in the spectrum of black body, Wien's distribution, Rayleigh-Jeans, Stefan Boltzmann law and Planck's law.

Solid State Physics

Amorphous and crystalline materials, lattice translation vectors, lattice with basis, unit Cell, SC, BCC and FCC lattices, CsCl and NaCl structure, Bragg's law, X-ray diffraction. Miller indices, reciprocal lattice, types of lattices, Brillouin zones, diffraction of X-rays by crystals, Bragg's law, atomic and geometrical factor. Lattice vibrations in monoatomic and diatomic chains, acoustical and optical phonons. Dulong and Petit's law, Einstein and Debye theories of specific heat of solids T^3 law, Band theory of solids: metals, insulators and semiconductors. Superconductivity: type-I and type-II superconductors.

Quantum Mechanics

Origin of Planck's Quantum theory, Photoelectric effect, Compton effect, Heisenberg Uncertainty principle, Wave particle duality, de Broglie theory, Davisson-Germer experiment, Wave description of particles by wave packets, Group and Phase velocities and relation between them. wave function, probabilities and normalization, Schrödinger wave equation with application to 1D potential problems such as potential in a box, step potential and rectangular potential Barrier.

Atomic Physics

Bohr, Somerfield and vector atom model, Electron spin, Pauli Exclusion principle, Stern-Gerlach experiment, Hund's rule, Spin orbit coupling, Total Angular Momentum, L-S and J-J couplings.

Nuclear Physics

Binding energy, Liquid drop model, Semi-empirical mass formula, Radioactivity, Mean and half-life, Alpha decay, Beta decay, Gamma emission.

Electronics

Intrinsic and extrinsic semiconductors, P-N junction, Zener diode, Light Emitting diode (LED), photo-diode, solar cell, Bipolar Junction Transistor, Transistor biasing, Transistor configurations: CE, CB and CC transistor amplifiers, Active, cut-off and saturation regions, Current gains α and β.